Comparing two different protocols for tilt table testing: sublingual glyceryl trinitrate versus isoprenaline infusion

S Oraii, M Maleki, M Minooi, P Kafaii

Abstract

Objective—To assess the diagnostic value and safety of sublingual glyceryl trinitrate tilt testing compared with isoprenaline infusion in patients with unexplained syncope.

Design—Glyceryl trinitrate and isoprenaline tilt tests were performed in two successive days on a random basis in cases and controls.

Setting—Outpatient cases with syncope referred to Shahid Rajaii Heart Hospital.

Subjects—65 consecutive patients with unexplained syncope after thorough work up; 20 healthy volunteers.

Results—Positive responses were observed in 20 patients during the passive phase. Of the other 45 patients, positive responses occurred in 25 cases during the glyceryl trinitrate phase and in 26 cases during the isoprenaline phase. In the control group, positive responses during the passive, glyceryl trinitrate, and isoprenaline phases occurred in one, one, and two cases, respectively. The sensitivity and specificity of the protocols were 55% and 94.7%, respectively, for glyceryl trinitrate and 58% and 89.4% for isoprenaline. Owing to discordant responses in 75% of the cases, the sequential use of the tests (if one was negative) would increase the sensitivity to 84% while decreasing the specificity slightly (to 84%). Side effects were less frequent with glyceryl trinitrate.

Conclusions—Sublingual glyceryl trinitrate tilt testing is an effective and safe alternative to the isoprenaline infusion test and can be used as a complementary test.

(Heart 1999;81:603–605)

Keywords: syncope; tilt table test; isoprenaline; glyceryl trinitrate

Tilt table testing is a widely accepted tool for confirming the clinical diagnosis of neurocardiogenic or vasovagal syncope. Several adjunctive pharmacological agents have been proposed to increase the sensitivity of the test, but isoprenaline infusion has remained the most popular. Isoprenaline infusion however, is rather cumbersome, undesirable in many patients with organic heart disease, and relatively often has side effects. This study was designed to compare the diagnostic value and tolerance of sublingual glyceryl trinitrate and isoprenaline infusion during tilt testing in the same group of patients.

Methods

PATIENTS

We studied 65 consecutive patients with unexplained syncope (26 men, 39 women; age 17 to 56 years, mean (SD), 34 (11.2) years). The number of episodes of syncope varied from one to 20 (mean (SD), 3.3 (3.8)). No abnormalities were found after a careful physical examination (including orthostatic blood pressure measurements and carotid sinus massage), routine laboratory tests, 12 lead electrocardiography, echocardiography, and 24 hour Holter recording. Other investigations, including stress tests, electrophysiological studies, angiography or computed tomography of the brain, were performed if clinically indicated.

CONTROL GROUP

Control subjects were 20 healthy volunteers (10 men, 10 women; age 17 to 56 years, mean (SD), 29 (9.5)). They had no history of syncope or presyncope and no evidence of any abnormalities on physical examination, electrocardiography, and echocardiography.

TILT TABLE TEST PROTOCOL

Informed consent was obtained from all patients and control subjects. Both isoprenaline and glyceryl trinitrate protocols were performed in each patient and each control subject on two successive days, in random order. Tests were performed in the morning after an overnight fast. An intravenous cannula was inserted at least one hour before the start of both protocols. No subject was taking any drugs. The room was quiet with dim lights. An electronically controlled table with footboard support and restraining belts at chest level was used. The ECG was continuously recorded and blood pressure was recorded by non-invasive sphygmomanometer every three minutes or less if necessary.

Passive phase

After 15 minutes of rest in the supine position, the table was tilted to 70° and the tilt was continued for up to 45 minutes. Pharmacological provocation was then started as described below if a positive response was not encountered.

Glyceryl trinitrate phase

Patients received 400 µg of sublingual glyceryl trinitrate and continued to be tilted at 70° for a maximum of 20 minutes.
ISO, isoprenaline; GTN, glyceryl trinitrate.

Values are mean (SD).

### Table 1 Summary of positive responses

<table>
<thead>
<tr>
<th>Case</th>
<th>Passive phase</th>
<th>ISO phase</th>
<th>GTN phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive responses</td>
<td>20/65 (31%)</td>
<td>26/45 (58%)</td>
<td>25/45 (55%)</td>
</tr>
<tr>
<td>Time to response (mins)</td>
<td>15.5 (7.3)</td>
<td>11.0 (3.9)</td>
<td>11.2 (3.7)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Controls</th>
<th>Positive responses</th>
<th>Time to response (mins)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive responses</td>
<td>1/20 (5%)</td>
<td>12.0</td>
</tr>
<tr>
<td>ISO phase</td>
<td>20 (77%)</td>
<td></td>
</tr>
<tr>
<td>GTN phase</td>
<td>13 (52%)</td>
<td></td>
</tr>
</tbody>
</table>

Types of response described in the text.
ISO, isoprenaline; GTN, glyceryl trinitrate.

### Table 2 Types of response

<table>
<thead>
<tr>
<th>Types of response</th>
<th>Type I (65%)</th>
<th>Type II (30%)</th>
<th>Type III (5%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive phase</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISO phase</td>
<td>20 (77%)</td>
<td>4 (15%)</td>
<td>2 (8%)</td>
</tr>
<tr>
<td>GTN phase</td>
<td>13 (52%)</td>
<td>9 (36%)</td>
<td>3 (12%)</td>
</tr>
</tbody>
</table>

Types of response described in the test.
ISO, isoprenaline; GTN, glyceryl trinitrate.

**Types of response**

Responses were classified as type I or mixed (hypotension or bradycardia develops but ventricular rate does not fall to less than 40 beats/min for more than 10 seconds and without asystole for more than three seconds); type II or cardioinhibitory (hypotension with ventricular rate of less than 40 beats/min for more than 10 seconds or asystole for more than three seconds); and type III or vasodepressor (hypotension develops but rate does not fall more than 10% from the peak).

**Discussion**

Vasovagal syncope is thought to be the most common identifiable cause of syncope, but the clinical history may be unreliable owing to the possible absence of typical precipitating factors and prodromal symptoms. Isoprenaline is known to increase the sensitivity while decreasing the specificity of the test, but is mostly poor. Isoprenaline is known to increase the sensitivity while decreasing the specificity of the test, but it requires an unpleasant sensation with isoprenaline, though continuing the test, but tolerated glyceryl trinitrate well.

**Types of response**

Responses were classified as type I or mixed (hypotension or bradycardia develops but ventricular rate does not fall to less than 40 beats/min for more than 10 seconds and without asystole for more than three seconds); type II or cardioinhibitory (hypotension with ventricular rate of less than 40 beats/min for more than 10 seconds or asystole for more than three seconds); and type III or vasodepressor (hypotension develops but rate does not fall more than 10% from the peak).

**Discussion**

The sensitivity of passive tilt table testing has been variously reported as 19% to 69% but is mostly poor. Isoprenaline is known to increase the sensitivity while decreasing the specificity of the test, but it requires an infusion system and is unpleasant to many patients, with relatively frequent side effects.

The use of glyceryl trinitrate in the tilt test, first introduced by Raviele et al., is promising because the agent does not have to be infused and seems to be safer than isoprenaline. In this study we attempted to compare the two tests in the same patients and we showed comparable sensitivities for glyceryl trinitrate and isoprenaline protocols (55% vs 58%, respectively), with a somewhat better specificity for the glyceryl trinitrate protocol (94.7% vs 89.4%). As a typical pharmacological tilt test is routinely started with a passive phase, it is reasonable to sum the results of the passive and pharmacological phases when determining sensitivity and specificity. When this was done, the sensitivity and specificity of the tests were 71% and 85% for isoprenaline and 69% and 90% for glyceryl trinitrate, respectively. Owing to discordant responses, if the two tests are used sequentially (when one is negative), the sensitivity would rise to 84%, while the specificity would decrease slightly to 84%.

Our rate of positive responses during all three phases was lower than in some earlier studies. The rate of positivity of tilt table testing has been reported to be higher with more aggressive protocols, increasing severity of syncope attacks, shorter interval between the last episode and the test, younger age, and female.

A concordant response to isoprenaline and glyceryl trinitrate tests was observed in 13 cases only, while 38 cases (75%) showed positive responses with one or other test.

The mean (SD) times to positive response were not significantly different between glyceryl trinitrate and isoprenaline phases (11.2 (3.7) vs 11.0 (3.9) min, respectively), but they were shorter than for the passive phase (15.5 (7.3) min).

**SIDE EFFECTS**

Few significant side effects were encountered with either protocol. With isoprenaline, they included self terminating episodes of supraventricular tachycardia (two patients, one control), chest pain (one patient), headache (two patients, one control), and nausea (three patients, two controls). With glyceryl trinitrate, one patient and one control subject suffered from headache. The tilt test was interrupted because of side effects in two patients during isoprenaline infusion but no patient during glyceryl trinitrate testing. Many patients felt an unpleasant sensation with isoprenaline, though continuing the test, but tolerated glyceryl trinitrate well.

**RESULTS**

Positive responses are summarised in table 1. During the initial passive phase, 20 patients (31%) showed positive responses. With pharmacological provocation in the other 45 patients, positive responses to glyceryl trinitrate and isoprenaline occurred in another 25 (55%) and 26 (58%) patients, respectively. Types of response are summarised in table 2. In the control group, positive responses occurred during the passive phase in one case, during isoprenaline phase in two cases, and during the glyceryl trinitrate phase in one case.
Comparison of protocols for tilt table testing

sex.13 14 17 We could not identify any differences in these variables between our study and those with a higher rate of positive responses. As noted previously,13 15 discordant responses were seen in three quarters of the patients. This discrepancy suggests the presence of different pathophysiological subsets of patients with vasovagal syncope, provoked by different triggers. Alternatively, the reproducibility of the test may not be consistent, and this needs to be studied further. Nevertheless, when one test is negative, the positive response rate can be increased by performing the other test without significant loss of specificity.

LIMITATIONS

As noted by others,4 the definition of neurocardiogenic syncope is a clinical one and no gold standard exists. Thus the definitions of sensitivity and specificity are arbitrary. Day to day variability in response cannot be ruled out, though the order of performing the tests was selected randomly. Our control subjects were younger on average, but this is likely to decrease the specificity rather than to increase it, as positive responses are more prevalent in younger people.15

CONCLUSION

The glyceryl trinitrate tilt test is a better tolerated and equally sensitive alternative to isoprenaline tilt testing. It can be used as the first line provocative agent in tilt table testing, as a complementary test in patients with a negative isoprenaline tilt, or as an alternative to isoprenaline where there is a contraindication to catecholaminergic drugs.

Comparing two different protocols for tilt table testing: sublingual glyceryl trinitrate versus isoprenaline infusion

S Oraii, M Maleki, M Minooii and P Kafaii

Heart 1999 81: 603-605
doi: 10.1136/hrt.81.6.603

Updated information and services can be found at:
http://heart.bmj.com/content/81/6/603

These include:

References
This article cites 15 articles, 1 of which you can access for free at:
http://heart.bmj.com/content/81/6/603#BIBL

Email alerting service
Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Notes

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/